Both Sandhu and Hudson are directed toward carrier heads in which a compressible pad is disposed between a rigid backing member and the substrate. For example, Hudson includes resiliant pad 34 on the underside of a rigid wafer carrier 30. Similarly, Sandhu has a carrier pad (not numbered) on the underside of a rigid pressure applicator 106, such as a piston disk.

The pads of Sandhu and Hudson are generally known as a "carrier films", and are used to provide a cushion between the rigid backing member and the substrate. These carrier films are formed of a highly porous material. The porous nature of the carrier film permits the film to collapse under pressure so as to be compressible, and provides a high-friction interaction with the substrate.

In contrast, claim 1 calls for a fluid-tight flexible membrane with an inner surface that forms a boundary of a pressurizable chamber and a rough outer surface to press a substrate against a polishing surface.

First, neither Sandhu nor Hudson show a carrier head with a pressurizable chamber and a flexible membrane with an inner surface that forms a boundary of the pressurizable chamber.

Second, assuming that the Examiner cites a carrier head (such as 5,964,653 to Govzman), it would not be obvious to use the compressible pads of Sandhu or Hudson in such a carrier head. Specifically, the porous nature of the compressible pad permits fluid to pass through the pad, and therefore they cannot create a fluid-tight pressurizable chamber. Consequently, the pads of the type described in Sandhu and Hudson are not suitable for carrier heads in which an inner surface of the membrane forms a boundary of the pressurizable chamber. On the other hand, the membranes used in the later type of carrier head (such as Govzman) are conventionally manufactured by a molding process that creates a smooth outer surface.

With respect to claims 4, 13 and 14, the Examiner argues that inherently every material has grooves and/or vias which create some type of friction, even if microscopic. Applicant respectfully disagrees. Although nearly every material has some degree of friction, this friction is not necessarily due to surface features. In addition, claims 4 and 9 have been amended to call for macroscopic surface features. Applicant submits that this does not constitute new matter, as the membrane is discussed as being modified relative to the conventional membranes which the Examiner characterizes as having microscopic features.

Attached is a marked-up version of the changes being made by the current amendment.

Applicant asks that all claims be allowed. Enclosed is a $400 check for the Petition for Extension of Time fee and a $84 check for additional claim fees.

Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 4/8/02

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Version with markings to show changes made

In the claims:

Claims 6-8 have been cancelled.

Claims 1-2, 4-5, 9 and 11-12 have been amended as follows:

1. (Amended) A carrier head, comprising:

a retaining ring;

a pressurizable chamber; and

a fluid-tight flexible membrane with an inner surface that forms a boundary of the pressurizable chamber and a rough outer surface to press a substrate against a polishing surface. [, the flexible membrane having a roughened lower surface.]

2. (Amended) The carrier head of claim 1, wherein the outer surface of the flexible membrane is sufficiently rough that the substrate does not move or rotate relative to the membrane.

4. (Amended) The carrier head of claim 1, wherein the outer surface of the flexible membrane includes macroscopic features [such as grooves or vias] to increase its friction coefficient.

5. (Amended) The carrier head of claim 1, wherein the friction coefficient of the outer surface of the flexible membrane is sufficiently high [so] that the substrate does not move or rotate relative to the membrane during polishing.

9. (Amended) A carrier head, comprising:

a retaining ring;

a pressurizable chamber; and

a flexible membrane to press a substrate against a polishing surface, the flexible membrane including an inner surface that forms a boundary of the pressurizable chamber and an

outer surface having macroscopic surface features to increase [its] a friction coefficient of the outer surface.

11. (Amended) The carrier head of claim 9, wherein the [bottom] outer surface of the flexible membrane is roughened to increase its friction coefficient.

12. (Amended) The carrier head of claim 9, wherein the friction coefficient of the flexible membrane is sufficiently high [so] that the substrate does not move or rotate relative to the membrane.

Please add claims 16-19.

16. (New) The carrier head of claim 1, wherein the outer surface is rougher than the inner surface.

17. (New) The carrier head of claim 1, wherein the features are selected from grooves and vias.

18. (New) The carrier head of claim 9, wherein the outer surface is rougher than the inner surface.

19. (Amended) A carrier head, comprising:

a retaining ring;

a pressurizable chamber; and

a fluid-tight flexible membrane with an inner surface that forms a boundary of the pressurizable chamber and an outer surface to press a substrate against a polishing surface, wherein the outer surface is rougher than the inner surface.